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THERMOELECTRIC GENERATOR BC-13

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DATE: 17 March 1960

Project No. 2004-162

ABSTRACT

In general, the performance of the Thermoelectric Generator BC-13 when operated indoors compared favorably with the data supplied by the manufacturer. The unit did not function properly however, when it was operated out of doors under adverse weather conditions. Under these conditions, several undesirable characteristics were noted:

- (a) Winds of approximately 40 mph or greater blow out the fire.
- (b) Condensation can be observed rising from the unit when operated in relative humidity greater than approximately 75%.
- (c) Condensation collects at the apex of the cover and drips inside the unit.
- (d) The gas regulator is not protected from rain and snow.

1. INTRODUCTION

The Thermoelectric Generator BC-13 was manufactured by the

The generator was designed to charge batteries out of doors. It was tested to determine if it would perform its intended function and to compare the results with the instruction manual data furnished with the unit.

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2. MECHANICAL

2.1. Size and Weight

Size: Generator - 12 1/2" diameter x 15" high
Regulator - 9 1/2" x 6" x 10" high

Weight: Generator including accessories (less propane tank) - 24 pounds

2.2. Accessories

The following accessories were received with the unit:

- 1 regulator unit with small self-contained propane bottle and hose
- 1 gas hose with connectors
- 1 spark lighter
- 1 gas jet cleaner
- 1 Allen wrench
- 1 bottle of leak detector
- 2 fuel jets
- 2 flame screens.

3. ELECTRICAL

3.1. Battery Charging Test

Manufacturer

Battery:

10 Sonotone 5 AH Nickel-cadmium cells connected in series.

Conditions:

Battery completely discharged. Generator run at 1050° F for 1 hour to stabilize generator. A resistive load which drew 0.6A was used.

Ambient Temperature: 75° F

Gas consumption rate: 18.3 g/hr

Average charging current: 0.57A

Average battery voltage: 13.9V

Average power delivered by generator: 7.92W

Ampere hour input to battery during 9 hour test: 5.13 AH

Gas consumed to charge battery to 100% of nominal (5 AH) capacity: 162 g

R&D Laboratory

Battery:

10 Sonotone type 5H-10 5AH NICAD cells connected in series.

Conditions:

Battery completely discharged. Generator run at 1050° F with a resistive load that drew 0.6A for one hour.

Ambient Temperature: 75° F

18.8 grams per hour

0.56A

14.4V

8.06 Watts

5.04 AH

169.2 grams

3.2. Comparison of Performance Data

Manufacturer's Data

Voltage, open circuit: 26.0V DC
Voltage, matched load: 13.3 V DC
Current, matched load: 645 ma
Power output : 8.56 Watts
Temperature,
Hot Junction : 1100° F

R&D Laboratory's Data

27.6V DC
12.8V DC (17.0 ohms)
725 ma
9.25 Watts
1100° F

3.3. Power Output vs Load Resistance

Conditions of Test:

- (a) The generator was allowed to stabilize at 1100° F for one hour.
- (b) The load resistance was varied from 1 to 70 ohms and the voltage and current were recorded.
- (c) The temperature was held constant at 1100° F as indicated by the generator thermometer.
- (d) The power output was calculated $E \times I = P$.

Test Results:

See Figure 1

389-11 KEUFFEL & ESSER CO.
10 X 10 to the 1/2 inch, 5th 1/2" centered.
MADE IN U. S. A.

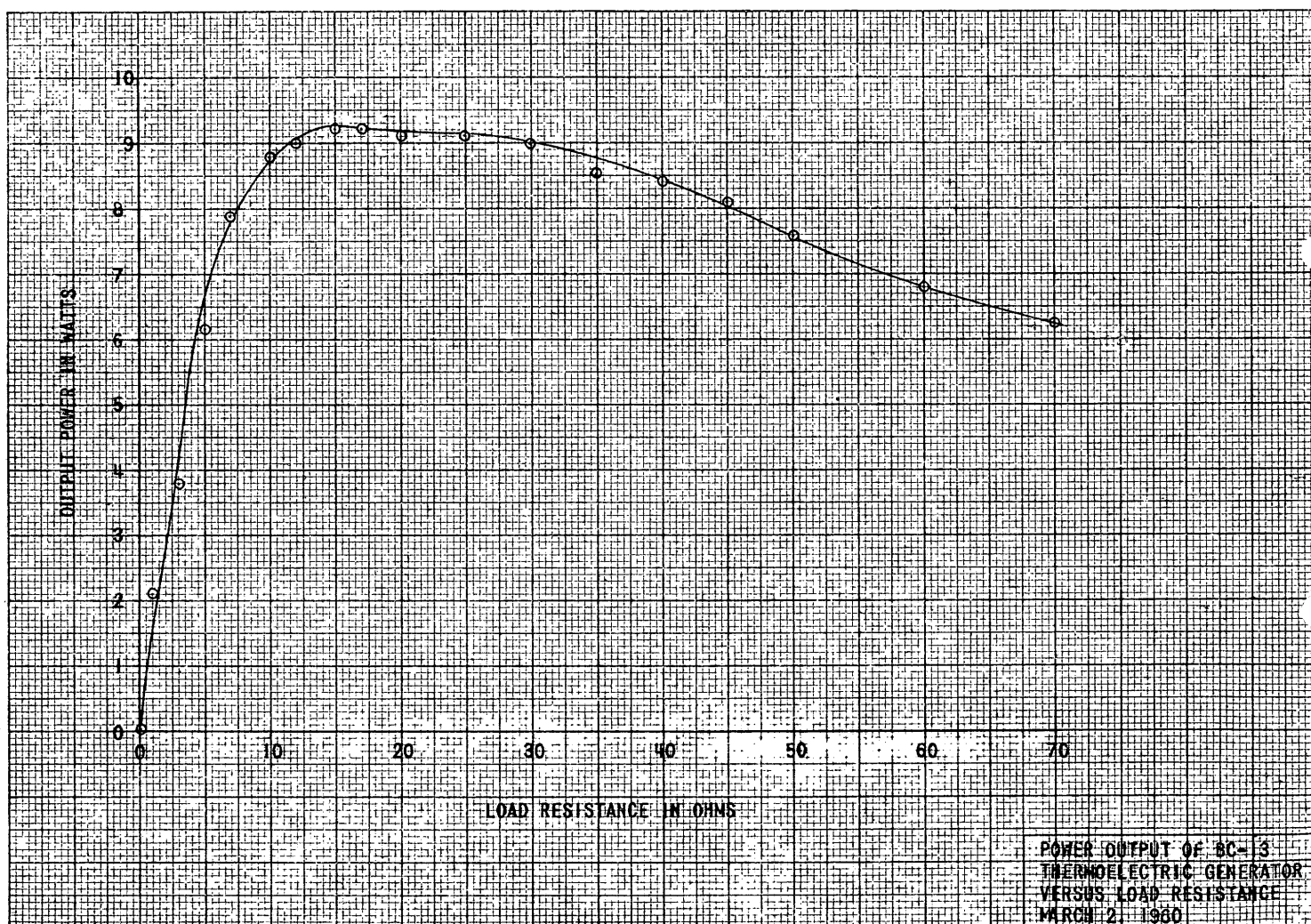


FIGURE 1

4. CONCLUSIONS AND COMMENTS

4.1. Conclusions

In general, the indoor performance of the Thermoelectric Generator, BC-13, compares favorably with the data published by the manufacturer. It does not operate satisfactorily out of doors when exposed to adverse weather conditions.

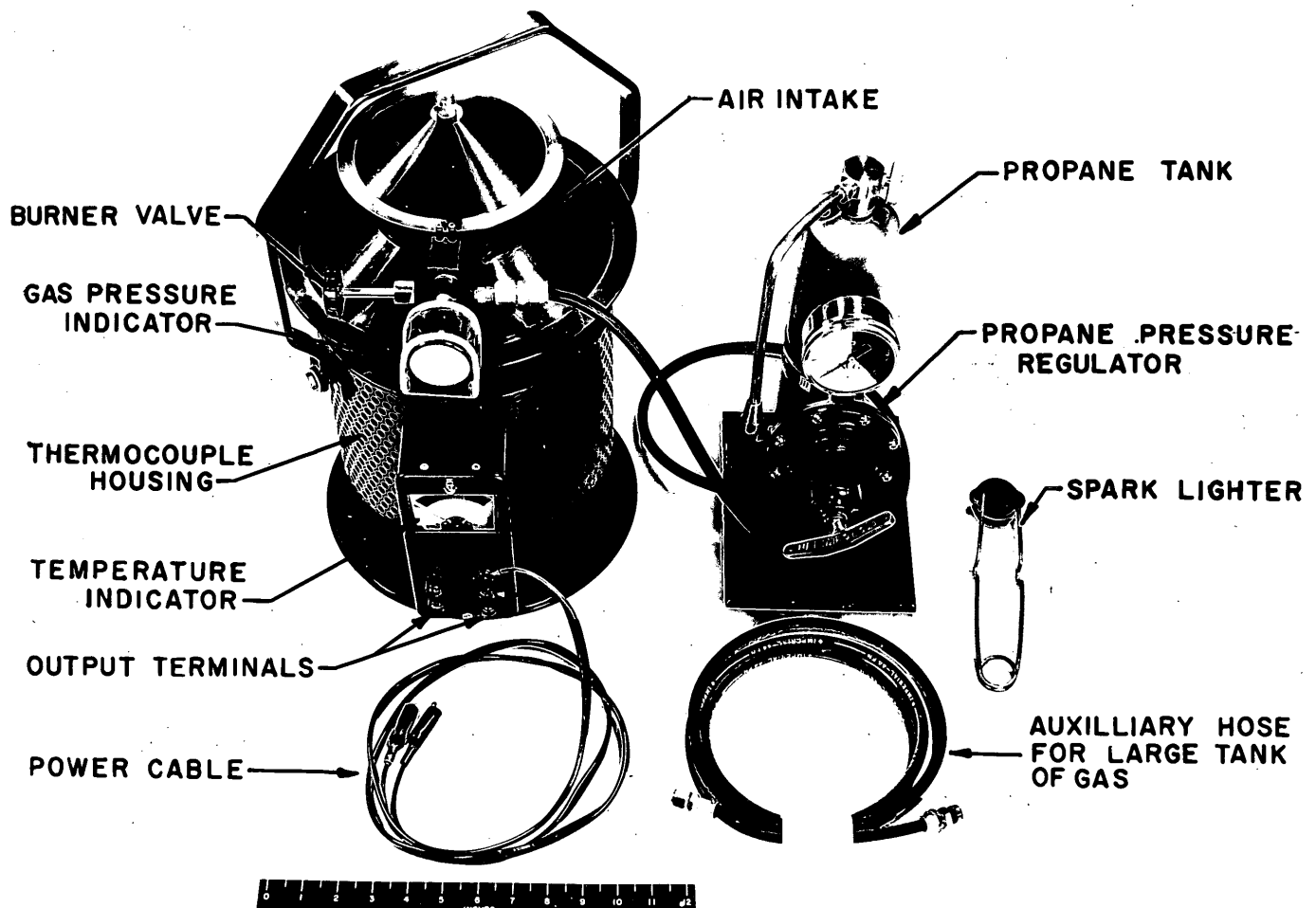
The unit performs its intended function of charging a 12.0V, 5 AH NICAD battery satisfactorily (operated indoors). It will also charge other types of rechargeable batteries whose cut-off voltage is not critical and whose capacity is not greater than approximately 60 AH* if time is not an important factor.

The unit is not recommended for charging silver-zinc or silver-cadmium batteries because it has no automatic cut-off.

4.2. Comments

- (a) In order to prevent the wind from blowing out the fire, a different type of air intake at the gas jet should be used.
- (b) A wind baffle should be placed around the top of the thermocouple housing to prevent formation of a draft.
- (c) Some means should be provided to prevent visual detection of the condensate (vapor) when the unit is operated under high humidity (75% or greater) conditions.
- (d) The top burner cover should be grooved from the apex to the edge so that the condensation (water) drips outside of the unit.
- (e) The gas regulator should be protected from rain.
- (f) The regulation of the gas to the burner should be accomplished by the regulator instead of the valve input to the burner as stated in the instructions. The regulation would then be more uniform when cold weather causes the gas pressure to decrease.

*The capacity of the generator is not sufficient to charge larger batteries.



OVERALL VIEW THERMOELECTRIC GENERATOR BC-13

FIGURE 2